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9 FEBRUARY 1987

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# China Report

SCIENCE AND TECHNOLOGY

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9 FEBRUARY 1987

# CHINA REPORT

## SCIENCE AND TECHNOLOGY

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## NATIONAL DEVELOPMENTS

### AIRCRAFT MANUFACTURING DEVELOPMENTS IN 1986 RECAPPED

HK301136 Hong Kong ZHONGGUO XINWEN SHE in Chinese 0349 GMT 26 Dec 86

[Report: "China's Civilian Aircraft Manufacturing Industry Has Achieved Considerable Development This Year"]

[Text] Beijing, 26 December (ZHONGGUO XINWEN SHE)--This reporter has learned of the following information from the Ministry of Aviation Industry today: China's civilian aircraft manufacturing industry has made great strides forward this year. A total of 15 Yun-7 planes are currently serving 9 domestic air routes, and the Yun-12 aircraft has entered the world market for the first time. The ministry recently signed an agreement with the Civil Aviation Administration of China (CAAC) to manufacture 40 Yun-7 planes for the CAAC during the Seventh 5-Year Plan.

These moves have realized the prediction made by Aviation Industry Minister Mo Wenxiang at the beginning of this year that China's aviation manufacturing industry would make new breakthroughs this year.

The Yun-7-100 aircraft, an improved version of the Yun-7 aircraft, underwent refitting in Hong Kong last year, underwent flight tests on major domestic air routes for appraisal purposes, and was rated acceptable and licensed by the CAAC. In June this year, the Xi'an Aircraft Manufacturing Corporation independently completed the remitment of the first Yun-7-100 aircraft.

The Yun-12 aircraft is a "sister" to the Yun-7 aircraft. China this year exported six Yun-12 aircraft, thus pushing sales of Chinese-made civilian planes on the world market for the first time.

The Yun-8 aircraft, which has attracted the CPC leadership's close attention, this year fulfilled a three year test flight plan for conducting scientific research on the aircraft's functions. The Yun-8 "Black Eagle" [Hei Ying 7815 7741] cargo aircraft passed various technical tests involving coming in and out of Xizang at all seasons this year. One of the key projects listed by the Ministry of Aviation Industry during the Seventh 5-Year Plan is the project to improve the Yun-8 aircraft's cabin pressurization. This project has moved from the stage of feasibility study into the stage of making technical designs.

This year China has also scored many achievements in expanding its aviation industry's technical cooperation and exchange with foreign countries.

The MD-82 passenger plane is the largest Sino-American technical cooperative item since the establishment of Sino-U.S. diplomatic relations. At present, the first MD-82 passenger plane's fuselage and wings have been joined. It is estimated that the plane will be flying by July next year.

To further expand the export of Yun-12 aircraft, China is actively cooperating with some countries in order to obtain airworthiness licenses from them. The aircraft will give a flying performance in Japan at the beginning of next year.

Chinese-made civilian aircraft have been well received by various quarters after attending the 27th International Farnborough Aviation Exhibition in Britain, the 60th Chinese export commodities fair in Guangzhou, and the Asian defense technology exhibition. Nearby countries have expressed intent to buy the Yun-12.

China and the MBB Corporation of the FRG have reached a new agreement on jointly manufacturing the MPC-75 passenger aircraft.

While importing technology and equipment, the Ministry of Aviation Industry has begun to carry out work of importing knowledge. Foreign experts have been successively invited to make investigations and give advice in China in order to raise, as quickly as possible, the standards of China's Yun-7, Yun-8, and Yun-12 aircraft.

During his recent inspection of the MD-82 aircraft assembly shop at the Shanghai Aircraft Manufacturing Corporation, General Secretary Hu Baobang stressed once again the necessity of successfully integrating self-reliance with the import of technology. In early December this year, the State Council held a seminar on the policy of developing China's civilian aircraft. China's aviation circles are currently conducting discussions on the manufacturing of new types of main and auxiliary airliners. We can predict that with a series of policies adopted by the state to support the aviation industry, China's civilian aircraft manufacturing industry will achieve greater development next year.

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CSO: 4008/28

## NATIONAL DEVELOPMENTS

### NATION SEEN SEEKING JOINT VENTURES FOR ROBOT PRODUCTION

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DIE WIRTSCHAFT in German 10 Dec 86  
p 2

[Article by Peter Odrich, Hong Kong: "China Planning Own Robots. Close Cooperation With Foreign Firms Sought"]

[Text] When the production of robots was first proposed in China in 1972, the political leadership was quick to say no. Opponents argued that the country did not need robots since so many human operatives were available. Major changes have taken place in the meantime. In Shenyang, an industrial city in the northeast, construction has begun on a research and development center for so-called second generation robots. Chinese leadership is today counting upon an increase in the country's industrial productivity through their use.

The Shenyang facility is scheduled for completion in 1988 and will consist of initial test production centers and four laboratories. Designated as the Chinese Academy of Sciences Shenyang Institute of Automation, the center will concentrate on the development of underwater robots for oil extraction, so-called intelligent robots and defices which can adapt independently to various operating conditions.

It is also hoped, according to sources in Hong Kong, that foreign firms will cooperate with Chinese plants in joint ventures for the production of industrial robots. The PRC is aiming primarily at domestic markets with such production. Exports, though of secondary priority, are also envisioned. In the view of foreign firms in Hong Kong, China is definitely in a position to produce top quality robots. There is also a substantial demand for them in the PRC.

Currently, however, few plants in the PRC have production facilities capable of making effective use of robots. In this regard, a consultant and training role has also been assigned to the new center at Shenyang. Initial applications are planned in the areas of coal extraction and motor vehicle enameling. Reasons for this are much the same as those found in Western countries: workers are to be spared heavy and dangerous work.

The new Shenyang Institute of Automation is already cooperating with the U.S. firm of Perry Offshore, Inc, and intends to integrate this partner's



technologies for the development of underwater robots. According to the agreement between the two partners, China will be able to use technology developed by Perry for a fifteen-year period and the products will carry the Perry trademark. The underwater robots will be employed in oil exploration and in dam construction. The devices will be capable of laying oil pipelines and of undertaking tasks which previously had required thousands of laborers.

China expects to be able to export the first underwater robots as early as 1988. In addition to the technology transfer from the United States, China will also seek to import robotics technology from Europe and Japan. Japan, however, has shown itself so far to be reluctant in this regard. On the other part, the PRC, because of its current shortage of hard currency, does not intend to import any robots of the so-called first generation. Instead, plans call for concluding cooperation agreements with foreign firms which will make it possible to produce equipment of this kind in the PRC.

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CSO: 4620/11

## NATIONAL DEVELOPMENTS

### PETROCHEMICAL COMPLEX PASSES STATE APPRAISAL

OW131236 Beijing XINHUA in English 1224 GMT 13 Dec 86

[Text] Shanghai, 13 December (XINHUA)--The Shanghai Petrochemical Complex passed a state appraisal here today on its second-phase construction. The appraisal was made by the State Planning Commission, China Petrochemical Corporation and Shanghai Municipal Government.

The first-phase construction project began 14 years ago, and the second was completed and put into trial production in early 1985.

The second phase generated 1.1 billion yuan (about 300 million U.S. dollars) in profits and taxes during the period of trial-production.

The total profits and taxes handed over by the complex in the past dozen years are equal to about 2.5 times the total state investment and government loans plus interest.

The Shanghai Petrochemical Complex has already provided 960,000 tons of polyester, acrylic and vinylon fibers. The complex, which enjoys rights to export, has exported its products to 23 countries and regions, including the United States, Japan and Australia.

In the past two years it has generated 77 million U.S. dollars in foreign exchange, according to an official at the complex.

The second-phase expansion project began in 1980. It is designed to produce 200,000 tons of polyester a year. With the completion of the second phase, the complex is able to produce 300,000 tons of chemical fiber, 60,000 tons of plastics, about 400,000 tons of chemical raw materials and some one million tons of oil products.

The official said the third-phase expansion project, which began in July 1985, is well under way. It involves the installation of an ethylene plant designed to produce 300,000 tons a year and seven other auxiliary installations.

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CSO: 4010/1013

## NATIONAL DEVELOPMENTS

### CHINA'S LARGEST COMPUTER GROUP INAUGURATED

OW171645 Beijing XINHUA in English 1436 GMT 17 Dec 86

[Text] Beijing, 17 December (XINHUA)--The Great Wall Computer Corporation Group, the largest of its kind in China, was formed here today.

Composed of 67 research institutes, enterprises, universities and technical service corporations in the Beijing area, the group has a total employment of 50,000, including 15,000 technicians.

Speaking at the opening ceremony, President of the corporation Wang Zhi said, "the group, combining scientific research with production, management, application, technical service and training, will become the country's northern center for developing computers of the fourth generation."

"As an outcome of the present structural reform in the computer industry," he said, "the new corporation will help avoid the repetition of research and production."

According to the president, the corporation will develop mainframe computers and microcomputers, digital switching equipment, software, engineering systems and integrated circuits, with an emphasis on new products which will be more competitive on both international and domestic markets.

Beijing, an important base of the electronics industry, produced China's first computer in 1958, and now employs 28,000 computer technicians, one-third of the national total.

The president said, "more research institutes and enterprises in other parts of the country are also eager to join us."

There are now 137,000 different kinds of computers in the country and over the past five years, the computer industry grew at an average annual rate of 43.8 percent.

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CSO: 4010/1013

## NATIONAL DEVELOPMENTS

### COMPUTER SURVEY OF INDUSTRIAL ENTERPRISES CONTINUES

LD190326 Beijing XINHUA in English 1538 GMT 18 Dec 86

[Text] Beijing, 18 December (XINHUA)--Data collected in a national survey of 360,000 industrial enterprises is now being processed by computer, State Councillor Zhang Jingfu said here today.

"The analysis is expected to be completed by the end of next September," he announced at a national meeting here this evening.

China's largest-ever industrial survey was organized by the [words indistinct] council and started at the beginning of this year. It has questioned not only state and collective enterprises but also industrial enterprises set up solely with foreign investment and joint ventures. It recorded more than 300 items of interest including fixed assets, output value, profit, taxes, consumption of raw materials and production costs.

"With concerted efforts made by central and local departments concerned," Zhang said, "statistical errors are kept to within three per thousand when the reports reach the provincial level."

The state councillor, who is also in charge of the industrial survey, said that the huge volume of statistics, after being analyzed, would be used by decision-makers for mapping out long-term development plans in line with the present economic reform. They would also help enterprises evaluate their production and management performance in an effort to find ways of increasing their efficiency and product quality, he added.

As of the end of October, he said, about 170,000 reports on the initial results of the survey had been written and 320,000 suggestions made.

The statistics will be compiled and published and some of them will be translated into English to provide more information to foreigners who want to invest in China, he added.

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CSO: 4010/1013

## NATIONAL DEVELOPMENTS

### OFFICE AUTOMATION BOOSTS WORK EFFICIENCY, QUALITY

OW180850 Beijing XINHUA in English 0647 GMT 18 Dec 86

[Text] Beijing, 18 December (XINHUA)--Computers, telegraphs, telexes, duplicators and other modern office and communication equipment have entered China's offices and have become capable assistants.

The offices of the State Administration of Building Materials Industry have used computers in the work of industrial production statistics, financial statistics, choosing programs of general survey of industry and processing official documents. Efficiency and the quality of work have increased as a result.

The financial and banking system, railway traffic sector and the administrative office of economic statistics are the most automated offices in the country. The ministries of the state have been equipped with telegraphs and communication has apparently improved.

The State Administration of Building Materials Industry set up an information bureau and a computer centre last year. The utilization of the software has been strengthened.

The computer centre has created decoding software and a superior document mimeograph system for which they were given an award at the National Computer Application Exhibition. So far more than 20 software applications have been put into production.

Song Ling, director of the computer centre, told a reporter, in order to promote the effectiveness of information, the State Administration of Building Materials Industry has provided more than 400 telegraphs for the administrative sectors and some enterprises of provinces, cities, autonomous regions, the open coastal cities and the cities whose plans are specially listed. The national information net of building materials industry has initially been established.

Using the established information system, the information bureau and the computer centre provided information service for the administrative sectors of the building materials industry of the provinces, cities, autonomous regions and the enterprises.

The information bureau informed a factory under the Ministry of Aviation Industry that Zigong Glassworks in Sichuan Province and Luoyang Glassworks in Henan Province have introduced the membrane coating glass production technique. Giving up this introduction, they avoided repetition.

The State Administration of Building Materials Industry also strengthened the information service for enterprises in towns and villages. It provided market information and the government policy for the enterprises.

Song Ling said, the State Administration of Building Materials Industry is making an effort to build the computer information management system supported by various data banks. This system will be put into the state economic information network. It will compose a complete modernized information management system of building materials industry with the policy-making bodies at all levels. The storage and retrieval of various statistical tables and reports and information materials will be automatically handled and provide various reference programs of scientific policy-making and production management information.

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CSO: 4010/1013

## NATIONAL DEVELOPMENTS

### COMPUTER DEVELOPMENT CORPORATION SET UP

OW121350 Beijing XINHUA in English 1245 GMT 12 Dec 86

[Text] Beijing, 12 December (XINHUA)--A national computer corporation, combining research with development, manufacturing, marketing, maintenance and trade, was set up here today.

The China Computer Development Corporation, affiliated to the Electronics Industry Ministry, is aimed at raising the technical level of the computer industry and spreading the use of computers through good service.

China's computer industry now boasts 100,000 employees working in 250 research institutes, production units and technical service corporations. It is capable of turning out more than 100 mainframe computers and 30,000 microcomputers a year.

Wang Zhi, president of the corporation, told XINHUA that the computer industry has always done technical research first, then put its achievements into production, and finally looked for a market for its products.

"The order must be reversed, and market investigation should be the forerunner of production," he said.

"The emphasis in computer development will shift from hardware to software, information and technical services," Wang said. "Joint efforts will be made in cooperation with the other four national corporations in charge of computer technical services, computer systems engineering, software techniques and computer-room facility engineering," he added.

In the near future, he said, priority will be given to the development of microcomputers. The 16-bit Great Wall 0520-c microcomputer developed last year is up to the advanced international standard and can be operated in both Chinese and English. Its output this year will surpass 10,000, about one-third of the national total.

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CSO: 4010/1013

## NATIONAL DEVELOPMENTS

### NON-METALLIC CHEMICAL EQUIPMENT EXHIBITION OPENS

OW311344 Beijing XINHUA in English 1321 GMT 31 Oct 86

[Text] Beijing, 31 October (XINHUA)--A national exhibition on non-metallic chemical equipment and materials, the first of its kind ever held in China, opened here at the Military Museum of the Chinese People's Revolution today.

On show are exhibits including towers, storage tanks, mixing machines, separators, filters, heat exchanges, fans, pumps, valves, pipes and other chemical equipment made of plastics, glass fibre reinforced plastics, rubber, enamel, pottery and porcelain, glass, graphite, granite and other non-metallic materials. They were provided by 76 scientific research units, colleges and factories throughout China.

Anti-corrosive products like those at the exhibition are important because China's chemical industry suffers a loss of more than 1.6 billion yuan a year due to chemical corrosion of equipment, according to an official from the China Association of Chemical Anti-Corrosive Technology.

China's scientific research units must make still bigger efforts to develop new anti-corrosive equipment and spread the research achievements, said an official from the China Association of Chemical Anti-Corrosive Technology.

The exhibition, jointly organized by the China Association of Chemical Anti-Corrosive Technology and the Beijing Exhibition Hall for New Imports, will close 7 November.

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CSO: 4010/1013



## NATIONAL DEVELOPMENTS

### BRIEFS

TIANJIN ELECTRODES PASS EXAM--Beijing, 12 August (XINHUA)--Five new products of the Tianjin Welding Electrode Plant, a major electrode producer in China, passed a joint quality examination by experts from seven countries early this month, today's PEOPLE'S DAILY reported. The quality of these products reached the top grade agreed by the seven countries of Britain, China, Federal Germany, France, Japan, Norway and the United States. So far, 13 products of the Tianjin factory passed this form of examination, it said. The Tianjin electrodes are selling well in more than 50 countries and regions. The factory, with an annual output of more than 60,000 tons, earned five million U.S. dollars during the first half this year, 20 percent increase over the same period last year, it said. [Text] [Beijing XINHUA in English 0552 GMT 12 Aug 86 OW] /12858

XINJIANG MICROCOMPUTERS--Urumqi, 2 Nov (XINHUA)--The multi-national Xinjiang Uygur Autonomous Region in northwest China is using more than 1,500 microcomputers in the industrial, financial, scientific, educational, and commercial departments. To spread the use of computers, the Xinjiang branch of the Chinese Computer Service Company and the Xinjiang Physics Institute attached to the Chinese Academy of Sciences have provided technical consulting and maintenance services and offered more than 50 training courses since 1983. With computers, the Power Supply Company in Urumqi, capital of the region, saves more than 200,000 yuan (about 54,000 U.S. dollars) a year. [Text] [Beijing XINHUA in English 0232 GMT 2 Nov 86 OW] /12858

DAQING ELECTRONIC COMPUTER NETWORK FORMED--4 December (XINHUA)--Daqing, which provides half of China's oil output, has formed an electronic computer network to handle, transmit and store all its data. An official at the northern Heilongjiang Province oilfield said here today that the network is the largest of its kind in China. It has 67 computers to handle data from more than 11,000 wells, measuring stations, oil tanks and waste-water treatment plants. The network will free a large number of technicians for other duties, accelerate information feedback and make the data more accurate, according to the official. [Text] [Beijing XINHUA in English 1218 GMT 4 Dec 86 OW] /12858

CHEMICAL FIBER PRODUCERS--Beijing, 19 December (XINHUA)--China this year is expected to turn out more than one million tons of chemical fibre, according to the Ministry of Textile Industry here today. The figure has made China one of the four biggest chemical fibre producers in the world, behind the United States, Japan and the Soviet Union. Statistical figures given by the ministry show that of the total materials for the textile production in China, 27 percent are for chemical fibre. China is able to turn out almost all kinds of the chemical fibres such as polyester fibre, acrylic fibre, polyamide fibre, polyvinyl alcohol fibre and polypropylene fibre. The sources said that seven large chemical fibre complexes have been built during the past few years. The sources said that the chemical fibre production in the country has been developing at what they called "an amazing speed". In 1970, China could only manufacture 100,000 tons of the products. The rapid progress, they said, has led twice to sharp sale price reduction of the clothing made from chemical fibres in the past few years. [Text] [Beijing XINHUA in English 1107 GMT 19 Dec 86 OW] /12858

SHANGHAI COMPUTER INFORMATION BANKS--Beijing, 20 December (XINHUA)--Shanghai has set up more than 30 computerized information banks, according to today PEOPLE'S DAILY overseas edition. They make this largest industrial center a leading information center in China, the paper said. Since 1984, Shanghai has given priority to promoting application of microcomputers to establish an information network to cope with its economic development. For example, the Shanghai Information Index System can provide information about the world's patent business, gardening, windstorms, construction engineering and power industry. A data bank for college graduates offers information about Shanghai's 50 colleges and universities as well as their graduates, the paper said. [Text] [Beijing XINHUA in English 1054 GMT 20 Dec 86 OW] /12858

COMPUTER EXPERTS SENT TO EUROPE, JAPAN--Beijing, 24 December (XINHUA)--Tianjin, one of China's 14 coastal cities open to outside investment, has sent 30 promising software programming technicians to work abroad this year, the PEOPLE'S DAILY reported today. Most of them have been sent to Britain, France, Japan and Federal Germany. "The purpose is to help China learn some advanced technology directly," the paper quoted Ling Zhaoyuan, chief manager of the Tianjin New Technology Development Group, as saying. In September of this year, four technicians from the group helped their counterparts in Japan develop a Chinese-character word processor, Ling said. The chief manager also said, "my group will send nearly 100 software personnel abroad to work on joint projects." [Text] [Beijing XINHUA in English 1248 GMT 24 Dec 86 OW] /12858

CHINESE-CHARACTER EDITING SYSTEM TESTED--Beijing, 26 December (XINHUA)--A new Chinese-character software system designed to simultaneously edit four documents on one screen, was tested here today. In addition to basic editing functions, each of the screen's four "windows" can be enlarged, made smaller or moved to another location. "The full screen Chinese-character editing system, the first of its kind in China, is unique in editing and printing compared to character-processing software made abroad," according to computer experts from the Chinese Academy of Sciences, Beijing University and

representatives from research institutes who attended today's appraisal meeting. The software experts also believe the new system is up to advanced international standards. Since the new program has more functions and is easy to use, computer experts and researchers recommend the new software be put on the market as soon as possible. The new editing system was developed in nine months by two young engineers of the Kunlun Electronic Printing Equipment and Service Corporation under the Electronics Industry Ministry. [Text] [Beijing XINHUA in English 1246 GMT 26 Dec 86 OW] /12858

ANHUI WEATHER RADAR--A weather radar project was recently completed on Huang Shan in Anhui Province. The project, located 1,841 meters above sea level is capable of monitoring accurately and effectively the weather conditions within a radius of 650 kilometers. Its equipment was designed and made by China, and all its technical features meet the international standards. On 16 October, a ceremony to dedicate the project was held on the spot. Among those attending the ceremony were Zou Jingmen, director of the State Meteorological Administration; and Meng Fulin, vice governor of Anhui Province. [Summary] [Hefei Anhui Provincial Service in Mandarin 1100 GMT 18 Oct 86 OW]

JU ATTENDS EQUIPMENT TESTING--The urea equipment of the Zhenhai General Petroleum Chemical Plant, with an annual production capacity of 520,000 metric tons, passed a state-level appraisal on 3 November after test-running 11,000 hours. The large-scale urea equipment was primarily designed, manufactured, and built domestically with foreign cooperation. Compared with imported whole-set equipment, it can save foreign exchange and investment by 67.8 and 25 percent respectively. Governor Xue Ju, Vice Minister of Chemical Industry Pan Liansheng, and leaders and experts of more than 120 units from all parts of China attended the appraisal meeting. [Excerpts] [Hangzhou Zhejiang Province Service in Mandarin 1000 GMT 3 Nov 86 OW]

PROBLEMS SURFACE--According to the West China edition of JINGJI RIBAO, after conducting investigation and study, the science and technology group of the Shaanxi Provincial CPPCC has stated that the structural reform of science and technology units is currently facing a multitude of difficulties, and some major problems urgently need solution. The experts on the investigation group held that structural reform of science and technology is being adversely affected by problems such as egalitarianism in distribution, duplication of or contradictions between imported projects and internal scientific research projects, slowness in proper allocation of science and technology talent, backwardness of science and technology intelligence and information, and failure of science and technology policies and management to dovetail. The experts stressed that these problems could only be resolved through thoroughgoing structural reform. [Text] [Xi'an Shaanxi Provincial Service in Mandarin 0200 GMT 26 Nov 86 HK] /12913

CSO: 4008/28

## HUD FIRE CONTROL SYSTEM DETAILED

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 10, 5 Oct 86,  
inside front cover

[Article by Xi Liyun [1598 0448 6663] and Xu Fuhui [1776 1381 3549]]

[Text] After the successful flight test of the HUD fire control system which was developed by the Institute of Electrooptic Equipment of China's Ministry of Aviation Industry, a series of additional improvements were made. In particular, the original seven modules of the system have been integrated into three, i.e., the pilot display unit, the pilot control box, and the electronic module (Figure 1); also, the large computer has been replaced by a multiple microprocessor system. The new system has successfully completed actual target shooting tests in flight. In addition to the adaptability test, the following tests were also conducted: camera-guided attack, inspection of navigation capability, inspection of "heat rays" using electrooptical projectiles, continuous computation of impact points (CCIP) for cannon, rockets, and bombs in an air-to-ground attack, and continuous computation of release points (CCRP). The flight tests showed that the system provides full capability and incorporates the most advanced technologies; it has also been shown to be user-friendly and highly reliable. The display pictures are stable and sharp with smooth lines and clear characters (Figure 2).

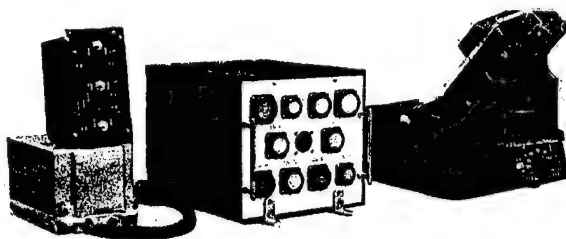


Figure 1. Components of the Chinese-Made HUD Fire Control System

The system can display more than 10 different types of images including shooting, bombing, navigation, landing, etc. It can also perform a variety of tasks such as leading track-and-aim attack, heat-ray rapid shooting, missile intercepts, missile tracking, continuous computation of hit points, and continuous computation of release points. The system has a 25° field of view with an instantaneous field of view of 17°x 17°, and weighs 35 kg.

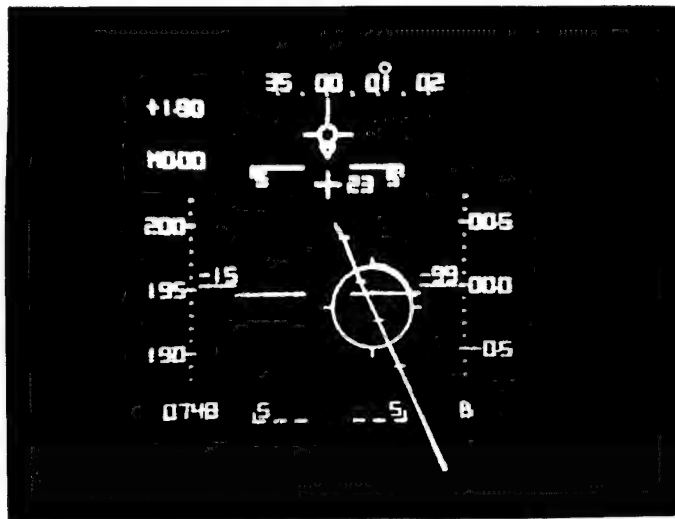


Figure 2. The Horizontal Display Unit

The system has participated in many international exhibits.

In October 1985, the state-operated Northwest Optical Equipment Factory and the Northern Automation Institute jointly announced the successful development of the 302 airborne HUD fire control system. The system has been certified by an audit committee organized by the military services, the Ministry of Aviation Industry and the Ministry of Ordnance Industry; it has also been tested on a Chinese-made fighter aircraft.

Integration of the 302 airborne HUD fire control system with other systems on the aircraft shows well-matched and highly accurate interfaces and stable and reliable operation. In particular, the software rate gyro was used in an airborne fire control system for the first time.

The 302 airborne HUD fire control system consists of three major components: the fire control computer, the horizontal display unit, and the weapons control box (see picture).

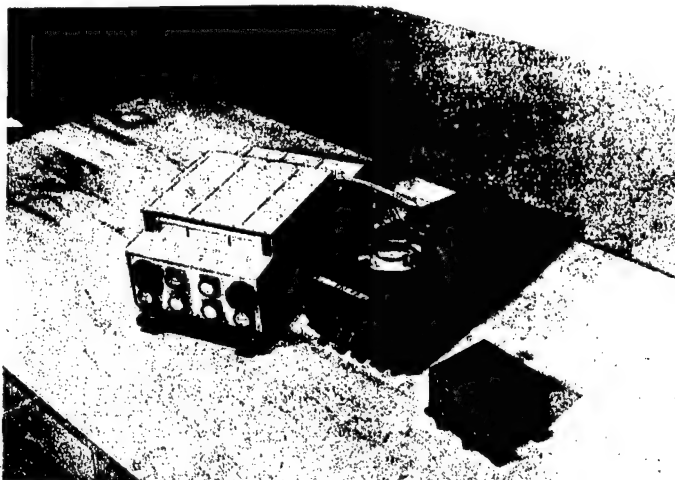


Figure 3.

The 302 fire control systems will be installed on Chinese-made fighter aircraft.

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## APPLIED SCIENCES

### 2405 FLIGHT CONTROL COMPUTER DESCRIBED

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 10, 5 Oct 86 p 7

[Article by Zhang Jinglun [1728 4842 0243] and Chen Yueting [7115 6460 1656]]

[Text] The 2405 computer is China's first flight control computer developed for digital autopilots and flight control systems. It uses the Intel 8086 as the main processor, and has many interface ports and supporting system software; it has also incorporated design measures for improved reliability. After many years of development and testing, the first batch of prototype 2405 computers has passed technical certification, and are being used on digital autopilot systems; the performance of the 2405 computer is comparable to those of similar products built by other countries in the early 1980's.

Because of its small size, superior performance, and its ability to operate under poor environmental conditions, the 2405 computer can also be used on vehicles, ships, and airplanes as well as for industrial process control.

#### I. Technical Characteristics

1. The main computer uses the 8086 16-bit microprocessor with an operating clock frequency of 5 MHz. The add instruction has a typical execution speed of 500,000 cycles/second.
2. The storage unit has a capacity of 16 KB in ROM and 2 KB in RAM, and each can be expanded to 32 KB.
3. It is equipped with a single-channel RS-232C asynchronous communication port, 24 programmable parallel ports and 3 channels of 16-bit counter/real-time clock.
4. It provides 32 channels of analog input and 8 channels of analog output; the A/D and D/A conversion has 12 bit accuracy.
5. It provides 48 channels of discrete input and 24 channels of discrete output; 32 of the channels are isolated photoelectrically.
6. The digital interface uses the 8051 monolithic chip to accommodate 3-channel multiunit communication ports or 3-channel ARINC 429 receiving units.

7. It has three control modes: program control, interrupt, and direct access.
8. The software package includes the monitor program, self-diagnostic program and flight control program. During the ground testing and check-out phase, it can also accommodate a compiler and screen editor.
9. It has a self-diagnosis capability with an error detection rate of greater than 90 percent. If necessary, it is possible to design a two-unit or three-unit fault-tolerant microprocessor system.
10. To facilitate testing and inspection, it can be connected to peripheral devices such as cathode tubes, row printers, and magnetic tape drives.
11. The average single-unit error-free operating time is greater than 2,000 hours.
12. Its size is one-half the ATR box, and its weight is 9 kg.
13. It uses a 28-volt DC power supply with an allowable power fluctuation of  $\pm 10$  percent.
14. To meet the requirement of operating under adverse environmental conditions, it is designed to operate over a temperature range of  $-55^{\circ}$  to  $+70^{\circ}\text{C}$ .

## II. Description of System Features

The 2405 microprocessor system is primarily designed to meet the computing requirements of flight control systems and other real-time control systems. The main features of the 2405 system can be summarized as follows:

1. It uses the Intel 8086 series processor and chips. The system consists of two models: the basic model and the enhanced model. The basic model is designed to meet the general flight control requirement, and the enhanced model, which is called the 80286 system, can meet the requirements of a multifunction system. The hardware and software of both models are upward compatible.
2. It has bus-oriented modular structure. In order to increase the flexibility in configuration and to facilitate expansion, a multicircuit bus structure is used; both hardware and software are modularized so that the user can assemble a system tailored to his needs.
3. It has a reliability design which is consistent with the features of flight control systems. The modules are defined according to the requirements of flight control systems; the number of unnecessary branch lines is kept to a minimum in order to simplify the logic design and to provide self-diagnosis and fault tolerance capabilities within the computer.
4. It uses reinforced structural technology. The computer housing is made of vibration-resistant integral structure; the circuit boards use fork-and-knife type plug-in components, and are directly fastened onto the aluminum frame. To achieve maximum heat dissipation, the system uses copper-plate for heat conduction and forced ventilation.

### III. Application of the 2405 Computer in Flight Control System

The first batch of the 2405 computers were used in digital autopilot systems; the main function of the microprocessor is to carry out control law calculations for the autopilot, to perform preflight checkout of the entire system and to monitor the status onboard the aircraft. The software first performs system initialization, followed by preflight checkout of the flight control system. After passing the self-diagnosis tests, it enters into the cyclic continuous program mode where calculations of status logic, control law, and on-line tests are carried out. These operations are repeated once every 50 milliseconds.

During normal operation, the program is executed according to the specified beat cycle, during which an output reset signal for the monitor unit is generated. If a malfunction occurs, the original beat is disturbed, and the program enters into a dead cycle. When timely output of reset signals are interrupted, the system enters into a state of alert.

To accommodate cross channel boards and redundant control software, three 2405 units can be combined to form a 3-degree-of-redundancy fault-tolerant microprocessor system, so that the probability of system failure is reduced to  $10^{-5}$ .

To facilitate ground testing, maintenance, and repair, the display panel has a row of illuminated diodes which can locate the defective component for easy replacement. If necessary, the user can also use various monitor commands to interact with the computer, or to inspect and test the application software.

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OSD603-1 COMPUTER PROGRAM DESIGNED FOR STRUCTURE ANALYSIS

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 10, 5 Oct 86  
pp 4-6, 11

[Article by Zhu Qixian [2612 0796 2009], Xi Shaou [1153 3097 7743], and  
Chi Huixian [6688 1979 6343]]

[Text] The OSD603-1 computer program is a software for structural design optimization developed by the Xi An Aircraft Design Institute; it is residing on the Xi Men Zi 7760 computer and has more than 10,000 lines of FORTRAN code. It can perform design optimization of fuselage structures under multiple constraint conditions with locally adjustable topologies.

The unique feature of the OSD603-1 software is that it combines mechanical and optimization problems with traditional design concepts and engineering processing methods. It incorporates advanced techniques and applies them to solve practical problems; it uses the ratio of design weight  $G_0$  to service weight  $G$  ( $k = G/G_0$ ) as a performance and reliability measure. The program contains different categories of longitudinal and lateral structural components, processing techniques, and materials. It incorporates practical stability analysis and methods of tension field calculations; it can be applied to fuselage structures or general thin-wall reinforced structures, it can be used for the design of reinforced frames and spars, as well as complex wing-fuselage structures. The program has fault diagnosis and data verification capability; it is a highly efficient program in that it can analyze a very large model in a reasonably short time.

The program was developed using a model-oriented approach. It incorporates such features as longitudinal and lateral merging, continuity, and upper/lower bounds; it also incorporates detailed process analyses and standard libraries to provide more realistic optimization results. The program uses dynamically allocated common blocks and virtual storage to minimize the use of magnetic disks; it also stores invariant intermediate results to improve computational efficiency. The program has certain user-oriented features such as data preprocessing, automatic generation of partial information, minimum bandwidth nodal optimization, and automatic calculation of partial loads to reduce the amount of manual data preparation. The program flow can be rearranged by using different loading modes and different control variables; the functional switches can be controlled using either an iterative or manual approach; the control parameters for the

optimization elements can be moved around with a great deal of flexibility and the range of optimization can be changed at any time. The documents have rewrite capability to facilitate modification and analysis of the optimization results.

#### Program Capability

The OSD603-1 software system can achieve design optimization for preliminary structural topologies under multivariable, multielement, multiload, and multi-constraint conditions. It can be used for adjusting structural configuration, selecting structural parameters and materials, and for weight estimation during the prototype design phase in order to obtain a minimum-weight fuselage structure which meets the requirements of strength, rigidity, length of life, and processing techniques. Its main capabilities are summarized below.

- (1) It can perform full-stress structural design.
- (2) It can perform design optimization while satisfying all or part of the following constraint conditions: stress, element buckling, overall rigidity, local displacement, service life, standardized processing, and upper/lower bounds of the variables.
- (3) It can perform preliminary local optimization which includes determining the number of stringers and frame distance, placement of cutout positions, and selection of the height of spar structure.
- (4) It can perform any of the following structural analyses: stress buckling analysis, overall rigidity analysis, service life and stress level analysis, and material nonlinearity analysis.
- (5) It can perform design optimization for fuselage structures subject to the following constraints: number of nodes of the finite-element model  $\leq 1,000$ ; number of degrees of freedom  $\leq 3,000$ ; number of design variables  $\leq 3,000$ ; and number of load groups  $\leq 20$ .
- (6) The program contains the following element libraries: three-dimensional variable-cross section, axially-loaded rod element, trapezoidal shear plate element, three-dimensional shear plate element of arbitrary quadrilateral shape, triangular plate element under normal stress, planar spar element, three-dimensional spar element, planar spar element with rigid hinge, three-dimensional torsion-free spar element, three-dimensional spar element hinged at one end, three-dimensional transition spar element with a flat end, and scalar element.
- (7) It can perform calculations for different load conditions, process and store the results, and automatically select the "effective load" in the design process.

## Structural Analysis of the Basic Elements Used in Design Optimization

### Shear Stress Plate Element

Because of the thin cover skin of the fuselage, it is more realistic to treat the normal stress load by using shear-stress plates with reduced areas than using normal-stress plate elements. Since the reduced area in the stressed region is a function of the local stress, the program uses a reduced area which corresponds to the design stress ratio (not necessary minimum). This is a more reasonable choice than using minimum reduced area because the full-stress design parameters, the stress analysis, and the allowable stress analysis all correspond to the same load conditions, and the stress errors are greatly reduced. Also, with this approach, the overall rigidity formation and decomposition need be carried out only once.

This program divides the plate elements into different categories, e.g., skin plate, longitudinal plate, cover plate, frame plate, and forged plate. Based on different load requirements, it can carry out full reduction, half reduction or no reduction of the normal stress, perform allowable stress analysis with or without entering the tension field, and carry out analysis and superposition under uniform load conditions. In calculating the allowable stress for a skin plate, its normal stress is determined from the normal stresses of the two neighboring stringers; the minimum normal stress values at the four corners of the two stringers are used to determine stress correlation; the maximum absolute values are used to determine stress correlation prior to entering the tension field, and the average value is used in tension field analysis. To ensure the reliability of the optimization results, a rather conservative approach is used in this program.

### Variable Cross Section, Equal Axial Load Rod Element

The program contains prestored information about different categories of rod elements: stringer rod, longitudinal rod, plate bending rod, forged rod, and pressed materials. It can carry out the calculations automatically based on the input category, or accept fixed input values, or search for the data corresponding to a particular model from the standard library based on the rod shape and area information.

### Spar Element

A good spar element design is one with small structural height, and with its flange area approximately equal to the web plate area. The key question is how to establish a relation between the area  $F$  and the moment of inertia  $J$ . The OSD603-1 program uses a hypothetical cross-section model which encompasses various cross-sectional shapes to derive formulas for computing the moment of inertia. From input design information, the program can calculate the moment of inertia of the actual cross section based on its area. In the case of a three-dimensional spar element, the program first determines the composite bending moment, then calculates the moment of inertia and height under oblique bending conditions using the rotating shaft theorem.

## Normal Stress Plate Element

It is known from mechanics that a triangular plate cannot withstand pure shear stresses, hence normal-stress plate elements must be used. Also, because thick forged plates do not suffer instability problems, it is not necessary to determine the critical stress using normal-stress plate elements; the design can be carried out using the "Fourth Strength Theory."

## Multiconstraint Design

### Combination of Multiple Constraints

In aircraft design problems involving multiple variables, the conventional approach is to use the criteria method for preliminary design. This method is simple, reliable, and effective. But generally, one criterion can treat only one corresponding constraint; in other words, this method is based on a discrete optimization approach. The so-called multiconstraint design refers to the entire structure; in actuality each element provides only a single constraint. In the OSD603-1 program, the elements are divided into corresponding constraint elements based on the "effective constraint" point of view. Thus, a complicated multiconstraint problem is systematically divided into individual single-element constraint problems, where each element is designed using the corresponding optimization criterion. As a result, the problem is greatly simplified, and optimum structural design is ensured.

In the multiconstraint optimization process, the structural rigidity is being continuously adjusted, and the internal stresses are constantly changing, which may lead to changes in the effective constraints. Therefore, during each iteration, the program automatically reallocates the effective constraints.

### Constraints on Service Life

During the prototype design phase, the stress level is generally increased as a result of using finite-element structural analysis and optimization technique; consequently, for parts of the structure which must satisfy antifatigue requirements, more stringent constraint on service life is imposed. First, damages of different design parts due to fatigue caused by different load groups are considered. Based on conservative life-design principles, the service life of the structure is estimated using linear cumulative damage theory; then the ratio between the estimated life and service is used to control and modify the stress level.

This antifatigue design approach is effective because it avoids possible delays in the design cycle in case the fatigue strength is found to be inadequate during verification.

### Nonlinear Analysis of Stress Constraints

When the operating stress level exceeds the elastic limit, a plastic correction is required. In a design involving multiple load groups, the degree to which each load group enters the plastic region is different. To simplify calculations,

we make use of the observed fact that the stiffness of an element is a function of the product of material and structural parameters (for a rod it is  $EF$ ). For the overall stiffness, the program maintains a constant modulus of elasticity  $E$  and computes that correct stiffness corresponding to plastic conditions using an equivalent area. In the case of multiple load groups, we use an approach similar to the normal-stress reduced-area method in computing the stiffness in order to unify and simplify the problem.

#### Preliminary Adjustment of Topology

Experience shows that the structural configuration has a significant impact on structural weight. The selection of structural configuration is an optimization problem with multiple objective functions because it must satisfy various design requirements. The problem of optimization of topology can be divided into two steps: selection of structural configuration during the system design phase, and adjustment of structural configuration during the prototype design phase. The first step can be accomplished via a man-machine interactive design process using a limited number of configurations at a CAD work station; the second step can be carried out automatically by the program to arrive at an optimum solution within a specified range. Since the cutout positions and variations in the height of spar structures only have localized effect, the program does not consider the interaction between the number of stringers and frame distance with other configuration adjustments.

#### Selection of the Number of Stringers and the Number of Frames

The number of stringers and the frame distance are adjusted by varying the number of longitudinal and lateral mergings of the stringers and frames. They are treated in a numerical procedure as optimization variables which coincide with structural variables on the same nodes of the model. They do not change the internal stresses of the structure, but only affect the allowable stresses of the elements; the range of influence under multiple load conditions is quite large. In aircraft design, generally the skin plate is a major design consideration for weight reduction; due to processing constraints, the skin is chosen to have uniform thickness. The program addresses the problem of making all small plates approach equal thickness in order to avoid unnecessary weight increase.

#### Arrangement of Medium and Small Cutouts

To avoid repeated data preparation, the program uses a dynamic procedure to adjust the positions of medium and small cutouts. Some of the cutouts of the original design are eliminated and replaced by the stiffness values of certain elements. The new cutouts are filled with low-stiffness elements, and different stress properties are assigned to these elements (stressed cover plate, shear-stressed cover plate, nonstressed cover plate) to arrive at a reasonable configuration. For a shear-stressed cover plate, while no normal-stress reduction is carried out, part of the shear flow of the cover plate is still transmitted through the cutout frame structure; in this case the program automatically selects the cutout model based on the assigned load requirement, and carries out the design of the frame structure using the calculated stress

values. The design of the frame structure can also be accomplished by the weighted value method.

### Selection of the Height of the Spar Structure

Under the condition that the exterior shape remains unchanged, varying the height of the spar only affects the coordinates of the node points of the computational model. The upper and lower limits of the spar dimensions can be determined from structural and processing requirements, then the optimum height can be selected using the lattice method.

For a circular frame structure or longitudinal spar, the spar height  $H$  and the flange/web plate thickness  $\delta$  are absorbed in the  $F$  and  $J$  of the spar element. The calculations are carried out in two steps; each step contains only one variable, and both steps use the same computational model. Therefore, the optimization problem which involves changes of the coordinates of the interior nodes is simplified.

### Sample Calculations

This program has been used in the calculation of more than 50 different model types and has been verified using standard test problems. It has also been used in prototype designs with satisfactory results. The sample calculations include the design of the fuselage tail section and the booster spar with redundant constraints on strength, processing, and stiffness; the design of sealed cabin in the forward fuselage (including service life) with redundant constraints; design optimization of spar element of a horizontal tail and adjustment of structural height; optimizing the number of stringers of the vertical tail; and selection of the structural configuration of the forward fuselage. The table below shows the results of three of the examples.

#### Example 1: Design optimization of the mid-fuselage section

The model includes the mid-fuselage, the central wing section, part of the outer wing section, and part of the forward and rear fuselage sections. By symmetry, a solution is obtained for one-half of the cross structure (Figure 1) which includes 1,127 rod and spar elements, 1,800 plate elements, 790 nodes, and 15 computation stations. Five design conditions are considered. Each iteration takes 3,183.3 seconds of CPU time. After three iterations the rod super stress ratio drops from 17.2 percent to 4.64 percent; the plate super stress ratio drops from 2.72 percent to 0.99 percent, and the weight is reduced by 36.53 kg, which is 16 percent of the total adjustable weight (the initial parameters are estimated based on experience and calculations using a simple engineering formula).

#### Example 2: Multiconstraint design of the fuselage tail section

The model has 12 computation stations, 8 of which are reinforced frames of the vertical and horizontal tails; in the longitudinal direction there are the booster spars, the spoiler plate spars, the guide rail spars, the thruster spars and the lower main spar. By symmetry, calculations are carried out for

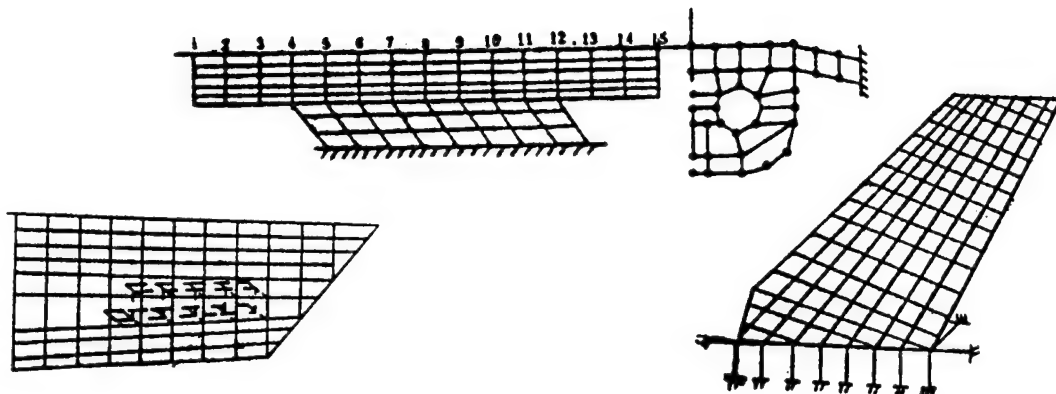


Figure 1.

a half model which has 407 nodes, 864 rod and spar elements, 535 plate elements, and 10 different load groups; the action point of the booster spar is subject to displacement constraint in the x direction. First a full-stress design is carried out, but the resulting stiffness shows that the displacement constraint cannot be satisfied, hence a multiconstraint design is carried out using two iterations.

Since the full-stress results fail to satisfy the stiffness criterion, the stiffness design involves a search process from the inadmissible region toward the boundary; this results in an increase of certain dimensions of the structure. There are 38 stiffness elements, which is approximately 7 percent of the total adjustable elements.

#### Example 3: Optimizing the number of stringers of the vertical tail

The model is a single block structure with front and back web-plate spars; there are 7 stringers and 26 ribs in the middle, but the wing tip, the leading edge, and the rudder are omitted. The base section is supported on the eight frame structures of the fuselage, and the supports are simulated by elastic members of the frames. The computational model has 384 nodes, 550 rod elements, and 368 plate elements.

The computational procedure consists of five full-stress iterations followed by three iterations for optimizing the number of stringers.

Although the strength and stiffness requirements are satisfied after five full-stress design iterations, the skin thicknesses are found to be too large (most are 0.25 cm, some are 0.3 cm). This is due to the rather large load at the rear spar section where the skin grid size is also large; as a result the entire skin thickness is increased because of the equal-thickness design criterion. After optimization, the number of stringers is increased to nine, which raises the critical stress of the skin plate, and the skin thickness is reduced to 0.15-0.25 cm. With increased number of stringers, the corresponding area per stringer is decreased, but the critical stress of the lower grade model is not necessarily smaller. Also, as the number of stringer margins is



increased, the normal-stress reduced area of the plate tends to increase, hence the weight of the stringers can be reduced.

The OSD603-1 system provides a versatile application software for design optimization of aircraft structures. While it has proven to be a practical tool in prototype design, constant improvements and enhancements of the program must be made to meet the needs of the advancing aviation technology.

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## APPLIED SCIENCES

### CHINESE SOCIETY OF AERONAUTICS, ASTRONAUTICS OUTLINED

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pp 12-13

[Article by Zhang Changling [1728 2490 7881]]

[Text] The Chinese Society of Aeronautics and Astronautics (CSAA) is an academic society organized by scientists and engineers in China's aerospace industry; it is part of the Chinese Science and Technology Association.

The CSAA was officially established in Beijing on 20 February 1964, and has grown to a society of more than 29,000 members. Its highest organization is the national member's convention. During the period when the convention is not in session, the society's activities are governed by the board of directors elected by the convention and the standing board of directors. The activities include technical exchanges, international relations, publications, promotion of science and technology, education and training, and technical consultation. The main objectives of the society are to fully utilize the talents and knowledge of the members and to take advantage of its accessibility to various organizations and different disciplines in order to promote the development of China's aerospace industry, to provide services to China's economic development and national defense, and to achieve socialistic modernization. The society has held three conventions. The chairman of the society during the first two conventions was Sheng Yuan, with Wang Junui as general secretary. During the third convention, the chairman was Ji Wenmei, with Wang Nanshou as general secretary.

The local aeronautical societies in China are sections of CSAA, and their activities are directed by CSAA. Today there are 12 local aeronautical societies: the Beijing Aeronautical Society, the Shanghai Aeronautical and Aerospace Society, the Heilongjiang Aeronautical Society, the Liaoning Aeronautical Society, the Jiangsu Aeronautical Society, the Jiangxi Aeronautical Society, the Shanxi Aeronautical Society, the Sichuan Aeronautical and Aerospace Society, the Guizhou Aeronautical Society, the Hunan Aeronautical Society, the Hubei Aeronautical Society, and the Jilin Aeronautical Society.

The CSAA has 16 special interest committees, and each committee has 53 special interest groups. These committees are: the aerodynamics committee, the flight mechanics and flight test committee, the structural design and strength committee, the dynamics committee, the electronics committee, the automatic

control committee, the materials committee, the manufacturing technology committee, the human engineering, flight medicine and rescue committee, the maintenance engineering committee, the science management committee, the composite materials committee, the test committee, the airborne weapon system committee, the helicopter committee and the light aircraft committee.

According to the charter of the society, the administrative office of the society is to be located in Beijing, where daily activities of the society are conducted under the direction of the general secretary and deputy secretary for special activities. The administrative office consists of the following branches: the main office, the department of science education, the department of international relations, and the editorial offices of AVIATION BULLETIN and AEROSPACE KNOWLEDGE.

Over the past 20 years, the society has initiated many activities and has made significant contributions to China's aerospace industry and to the four modernizations program. The main activities are summarized below.

**Technical Conferences.** The CSAA organizes dozens of technical conferences each year. During the 5-year period between 1981 and 1985, a total of 190 conferences were organized and 4,800 papers were presented; the total number of participants reached 15,100.

There are generally two forms of technical conferences. One is the combined annual convention, whose main objectives are to exchange and review the results of research in various disciplines, to discuss the activities of aerospace industries both at home and abroad, and to provide comprehensive technical advice to decisionmaking agencies. During the November 1984 conference held in Beijing entitled "Aviation in China in the Year 2000," 18 comprehensive reports were discussed. The report covered the current status and future projections of aerospace technology (year 2000); they also provided suggestions for the appropriate policies and strategies for technology development.

Another form is the special seminar, which is generally a conference dedicated to a special topic, and is organized by special-interest committees. These conferences are smaller in size and more flexible in form; they are suitable for in-depth discussions and exchange of ideas on certain specialized topics. Of course, the individual special-interest committees also organize their own annual conferences and discussion meetings; in some cases, they sponsor joint technical conferences with sister special-interest committees or corresponding special-interest committees of sister societies. For example, the military operations research seminar held in 1978, the early-warning aircraft conference in 1984, and the composite materials seminars given over the past few years were all very rewarding activities.

**Technical Consulting.** These are primarily activities designed to serve the four modernizations program. By taking full advantage of the society's ability to access various regions and agencies, and to organize workers in the scientific and technical fields, technical consulting activities provide direct service to China's economic development. The consulting activities of the society began in 1982 under the unified organization by the Chinese Academy of

Sciences; in September 1984, the technical consulting department was officially established. In its consulting activities, the society had made suggestions on policies and guidelines concerning such topics as the Zhi-8 helicopter, CAD/CAM, and reliability engineering. Now it is in the process of organizing academic activities for developing China's civil aviation. In addition, other important technical consulting tasks include: developing technology markets, promoting commercialization of technical achievements, and promoting the transfer of military technology for civilian use. The consulting department of the society has also established cooperative arrangements in technical and information services with the following cities: Qinhuangdao, Baoding, Fengrun, Shaoxing, Zhanjiang, Shantou, Guangzhou, Jiujiang, and Yantai. The individual special-interest committees and the local aeronautical societies have also established their own consulting departments; furthermore, they have developed cooperative relations with consulting offices of sister societies to form a consulting network for CSAA.

**Publications.** AVIATION BULLETIN was first published in 1965; in 1981 it became a bimonthly publication distributed both in this country and abroad. At the end of 1985, a total of six volumes had been published. The bulletin is a comprehensive technical publication of the society which reflects the latest results of research in various disciplines of aerospace science. In recent years, many papers, e.g., "A Class of Autonomic Finite Elements" by Zhou Tianxiao and "Dissipation and Diffusion of Turbulent Flow" by Gao Ge were papers of high academic standards and practical value; they both received national science awards and were highly regarded by Chinese and foreign academic communities. The first editor-in-chief of AVIATION BULLETIN was Professor Wang Derong, the second editor-in-chief was Professor Lu Shijia, and the current editor-in-chief is Professor He Qingzi. In 1985, the editorial office published a new journal named HANGKONG GONGCHENG, which primarily reflects the latest results of research in aeronautical engineering.

HANGKONG ZHISHI has been in existence for 27 years, and more than 30 million copies have been published; it is a very popular scientific magazine for the general public, particularly to young readers. It has motivated many youths to choose a career in the aerospace industry. Today, this magazine has a monthly distribution of 140,000 copies; each year, nearly 10,000 copies are sold in the United States, Japan, Southeast Asia, and in the Hong Kong/Macao area. Because of its outstanding achievements, the magazine has received citations from the Chinese Association of Popular Science Writers. The International Aviation Federation (FAI) also presented a certificate award to the magazine during its convention held in India; this was the first award ever given to a Chinese group by the FAI. In 1985, the CSAA and the Chinese Association of Aviation Sports jointly published a new popular science magazine, MODEL AIRCRAFT, in order to promote model aircraft activities among the younger generation.

Each year, the society also publishes a collection of technical papers and the corresponding abstracts. A number of special-interest committees and local societies also publish their own magazines such as AVIATION DYNAMICS and AERONAUTICS AND ASTRONAUTICS.

Science Education. This is another important function of the society. The society has sponsored numerous national youth aviation summer camps. During the 1984 national summer camp, 10 different camp sites were set up at Beijing, Shanghai, Jiangsu, Jiangxi, Liaoning, Shanxi, Heilongjiang, Hunan, Guizhou, and Sichuan; approximately 5,000 youths from 13 different ethnic groups across the country participated in this activity. The society also sponsored a number of science exhibits; for example, the exhibit "Civil Aviation Serving the Four Modernizations" in 1982, the exhibit "Modern Military Aircraft" in 1983 and the exhibit "Contributions of Ancient Chinese People to Aviation Technology" all received first prize for superior window display from the city of Beijing. To celebrate the 35th anniversary of the People's Republic, it teamed up with the Chinese Space Travel Society and the aerospace editorial committee of the Chinese Encyclopedia to create the "Pictorial Exhibit of Chinese Aeronautics and Astronautics," which was displayed in Xi'an, Xiangfan, Nanjing, Suzhou, Wuxi, and Qinhuangdao.

One of the key functions of the society is scientific training for its members; it has sponsored many training activities such as infrared technology short courses, microcomputer seminars, basic training classes in system engineering and economics. In order to make knowledge of aviation technology available to members of the aviation community and to the general public, and to promote the achievements of aviation technology, the society has also sponsored various conferences on popular science and new technologies.

International Exchange. It is an important avenue for enhancing friendly exchanges between international aviation communities, promoting friendship, and cross-fertilizing ideas and research results. The CSAA is a voting member of the International Congress of Aeronautical Science; it is also a member of the technical committee of ICAS. It has established friendly relations with foreign organizations including the American Institute of Aeronautics and Astronautics, the British Royal Aeronautical Society, the Japan Society of Aero and Space Science, the Italian Aeronautical Society, and the French Aeronautical Society. In 1983, the CSAA and the International Fracture Mechanics Organization jointly sponsored the International Fracture Mechanics Conference in Beijing. In 1985, the CSAA and the Gas Turbine Section of the American Society of Mechanical Engineers jointly sponsored the Beijing Gas Turbine Conference and Exhibit. In the near future, it is planning to sponsor joint conferences with other foreign academic organizations on the mechanical behavior of materials and on composite materials. The society frequently sponsors groups of scholars or specialists to attend technical conferences abroad and to visit and tour engineering facilities in other countries; it also invites foreign scholars to visit or give lectures in this country. It is the firm policy of CSAA to open its door to the world, to achieve modernization, to look toward the future, and to promote international technical exchange and friendship.

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## LIFE SCIENCES

### BRIEFS

USES FOR INSECT RESOURCES--Beijing, 1 December (XINHUA)--China's insects are an untapped source of national wealth, the GUANGMING DAILY said today. The paper published a letter from a staff reporter quoting entomologists at the first national conference on the topic as saying that cultivation of insect resources would contribute a bounty of new products and help preserve the balance of nature. Many participants urged the government to sponsor more research on insect resources and to establish a national insect research institute as well as promote nationwide understanding of the importance of safeguarding the insect population. At the conference in Guiyang, capital of south China's Guizhou Province, specialists said the current use of insects for shellac, insect wax and a handful of other products was too limited. "Insects could be used to make delicious dishes to eat," said one. "They contain lots of vitamins, proteins and amino acids." Others suggested that insects could be used to control cancer and leukemia. [Text] [Beijing XINHUA in English 1629 GMT 1 Dec 86 OW] /12858

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## ENVIRONMENTAL QUALITY

### STATE COUNCIL APPROVES ENVIRONMENTAL PROTECTION PROGRAM

OW231830 Beijing XINHUA in English 1242 GMT 23 Dec 86

[Text] Beijing, 23 December (XINHUA)--The State Council's Environmental Protection Committee today approved a massive new document titled "China's Nature Protection Program" at a meeting attended by leading officials from related ministries and departments.

The committee's director Qu Geping said "the program is China's first systematic plan to protect the environment and natural resources. It is both scientific and practical."

The program was developed by more than 200 specialists from government organizations and 13 national academic societies over the last three years, he added.

The director stressed that "it is an urgent strategic task to protect the environment and natural resources in order to accelerate the nationwide modernization program and obtain sustained growth in the national economy."

Although China is home to the world's largest population it has fewer natural resources and less arable land than many countries.

China's climate is also unpredictable, as some areas can suffer droughts while others are being flooded. With dry and semi-dry areas spreading, great economic losses will be caused if environmental protection isn't speeded up, warned the new document.

Divided into 19 chapters and four parts, the program spells out a detailed environmental protection plan in many areas including preservation of land, forest, grassland, desert, plant strains, land water resources, rivers, lakes, reservoirs, swamps, beaches, ocean, mineral product resources and atmosphere.

The program has set natural protection zones in northeast China, north China, the Loess Plateau, northwest China, central China, south China and the Qinghai-Tibet highland.

According to the program, northeast China will strengthen management of forests in order to maintain timber resources. In north China the plan calls for improved use of the land and better use of water resources.

Central China will attach great importance to water and soil conservation and forest protection while building more water conservation projects to protect against natural disasters.

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## ENVIRONMENTAL QUALITY

### IMPROVEMENTS IN ENVIRONMENT DURING SIXTH FIVE-YEAR PLAN NOTED

OW302325 Beijing XINHUA in English 1504 GMT 30 Dec 86

[Text] Tianjing, 30 Dec (XINHUA)--China increased its industrial production value by 65 percent in the years 1980-85, at the same time maintaining the quality of the environment, said a senior environment official.

Qu Geping, chief of the bureau of environmental protection under the Ministry of Urban and Rural Construction and Environmental Protection, made the remark when summing up economic growth and environmental protection during the last five-year plan (1980 to 1985).

He was speaking at a National Conference on Science and Technology for Environmental Protection, which ended here Monday.

The diversified rural economy has begun to turn the ecological cycle in the countryside from vicious to favorable. In addition, the country has launched campaigns to grow trees and grass and develop animal husbandry, especially in the north, to combat soil erosion.

China has completed the first phase of an afforestation project in the north, where six million hectares of trees have been planted to form networks that can protect eight million hectares of farmland from soil erosion.

Environmental conditions have begun to improve in one-third of the 396 counties in the northern region where erosion was the most serious.

An adjustment in industrial sectors has also promoted protection. Production technology has been upgraded in many enterprises, and those enterprises that seriously pollute the environment have been closed or removed from densely populated areas.

Compared to the situation in 1980, in 1985 China reduced outlets of pollutant water, dust and residues by 34, 47 and 36 percent, respectively. Also, 85 percent of new enterprises now adhere to the rule to design, build and start facilities of production and environmental protection at the same time.

Leaders in many cities and counties now list environmental protection as top priorities in their work.

Estimates in 1985 showed that all the 319 cities that have completed comprehensive urban planning have special environmental protection codes in the plans, and the majority of counties have similar plans.



## ENVIRONMENTAL QUALITY

### ENVIRONMENTAL PROTECTION EXPENDITURES DOUBLE, BUT 'STILL LOW'

OW211016 Beijing XINHUA in English 0653 GMT 21 Dec 86

[Text] Tianjin, 21 Dec (XINHUA)--China will pay more attention to researching and utilizing practical technology to protect the environment and fight pollution in the coming several years.

Addressing a national work conference on environmental protection here today, Jing Jianming, chief engineer at the Ministry of Urban and Rural Construction and Environmental Protection, said that the development of China's science and technology in the field should suit China's specific conditions by being practical, as the country is still poor.

"We should solve more problems with less money," Jing said.

During the Seventh Five-Year Plan (1986-1990), the state can only invest 100 million yuan (U.S.\$27 million) in the project, Jing said. "But even this figure is double that for the Sixth Five-Year Plan."

The main task in environmental protection is to continue to solve the problems created by waste gas, water, residue and noise pollution, Jing said.

"We will mainly research technology for overall control and prevention of pollution," Jing said, adding that the state will work out standards and regulations for released waste water, gas, residue and other pollutants both at the central and local levels.

"We will improve our monitoring methods and update our monitoring levels on poisonous chemicals and organic pollutants," he said.

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## ENVIRONMENTAL QUALITY

### MEASURES TO PROTECT SEACOAST BEING WORKED OUT

OW211024 Beijing XINHUA in English 0830 GMT 21 Dec 86

[Text] Beijing, 21 Dec (XINHUA)--China is working out specific measures to protect and explore seacoast and polder resources after completing its seven-year survey.

The survey, the first of its kind in the country, began in 1980 and involved more than 15,000 scientists and technicians. It was sponsored by the State Council in coordination with 11 provinces, municipalities and autonomous regions.

The scientists and technicians have made a survey of natural resources, the environment, and social and economic conditions of the coastal areas on 18,000-kilometer sea coasts with a total area of 350,000 square kilometers.

The survey has enabled more people to realize the importance of multi-purposed exploration of coastal resources, a scientist taking part in the survey said.

Some localities are drawing overall plans to explore seacoast and polder resources with survey data and results, which have also provided scientific basis for coastal industrial projects to install discharging facilities and build docks.

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## ENVIRONMENTAL QUALITY

### STATE COUNCIL PAYS CLOSE ATTENTION TO ENVIRONMENTAL PROTECTION

OW221158 Beijing XINHUA in English 0701 GMT 22 Dec 86

[Text] Tianjin, 22 Dec (XINHUA)--China's scientific research on environmental protection has entered a period of linking pollution control with the economy, natural sciences and multi-purpose utilization of resources and energy.

"This is a sign of marked improvement in China's environmental protection technology," said Jin Jianming, chief engineer of the State Environmental Protection Bureau at an ongoing national meeting in this field.

China has achieved more than 1,000 research results in pollution control and environmental protection since 1978, according to Jin.

At the meeting, all the provinces and cities offered reports on environmental forecasts for the year 2000 and methods for dealing with future problems. They used quantitative analysis to study the internal relations of economic growth, social development and quality of environment.

The country has conducted surveys on radioactive materials and on pesticide pollution. Environmental protection workers proposed 200 ways of analysing 60 key pollutants, said Jin.

China also built 360 nature reserves of all kinds and hundreds of ecological farm plots to test the balance of the ecology.

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## ENVIRONMENTAL QUALITY

### PROGRESS IN ENVIRONMENTAL PROTECTION OF BEIJING REPORTED

OW290338 Beijing XINHUA in English 0233 GMT 29 Dec 86

[Text] Beijing, 29 Dec (XINHUA)--The Beijing Government has completed 12 environmental protection and city beautification projects this year, according to Sunday's BEIJING EVENING NEWS.

The projects have brought under control 403 polluting sources in the western party of Chang'an Avenue and 352 in the Tiyyuguan Street of Chongwen District and some other sources and problems in Liuhai and Longtian districts.

The city has planted over two million trees and 1.37 million square meters of lawns and 250,000 flowers. It has also provided 8 residential quarters with facelifts.

The Yongding, Yudai and Machao rivers have been harnessed, improving the quality of potable water.

The number of boilers have been reduced thanks to the enlarged central heating system and gas for cooking has been supplied to another 100,000 families.

To control pollution from motor vehicles, the city government has checked and examined 40,000 new motor vehicles and revamped public buses.

A comprehensive system has been set up to monitor the city's polluting sources of the large iron and steel complex and chemical petroleum industries.

The government has also had about 70 polluting workshops removed from the downtown area while completing waste water treatment projects in 22 hospitals.

In addition, the city has set up 7 new garbage collection stations and two enclosed container type rubbish stations.

Tooting horns within the city's third ring roads is banned and tractors are not allowed to enter the third ring road.

Some workshops have been built in the suburbs and suburban counties to produce microbial pesticides to help protect agricultural ecology and the sources of drinking water against pollution.

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## ENVIRONMENTAL QUALITY

### DETERMINATION OF CHROMIUM(VI) IN INDUSTRIAL WASTEWATER BY SLOW INJECTION ANALYSIS

Beijing HUAXUE TONGBAO [CHEMISTRY] in Chinese No 11, Nov 86 pp 867-869

[English abstract of article by Yu Zhenan [0060 2182 1344] and Li Xiao [2621 0879] of the Department of Chemistry, North-East Institute of Technology]

[Text] A FIA method for the routine determination of Cr(VI) in industrial wastewater with chromophoric agent 1,5-diphenylcarbazide is described. 103 determinations run every hour and 100  $\mu$ l of sample volume is required for each determination. The determinable range and detection limit are 0 to 3.0 ppm and 0.03 ppm respectively. The relative standard deviation is 0.6 per cent. The results agreed well with those obtained manually. (Paper received 24 June 1985.)

### REFERENCES

- [1] S.S.Jorgensen et al., *Analyst*, 106, 292(1980).
- [2] J.Ruzicka et al., *Anal.Chim.Acta*, 114, 19(1980).

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